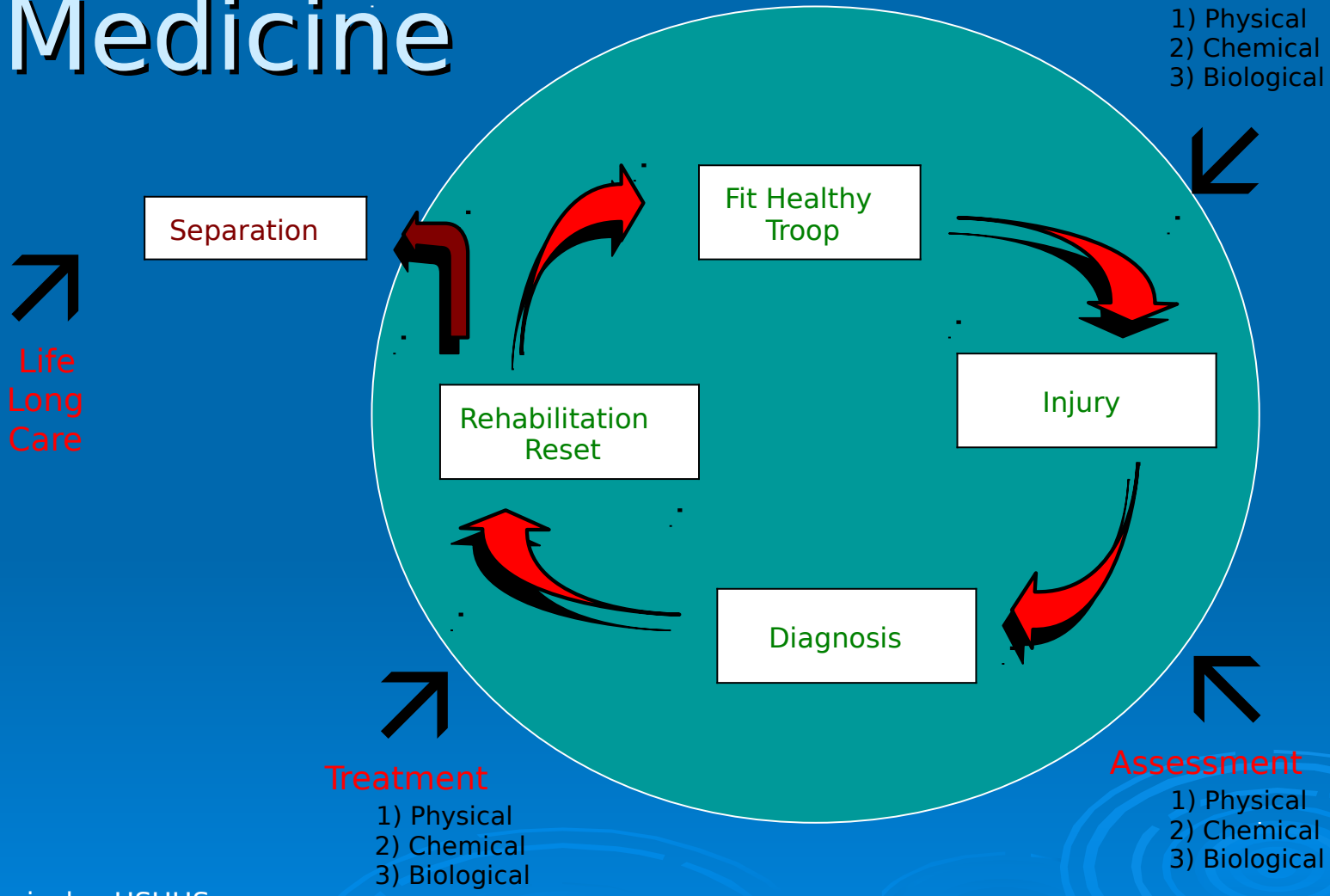
Successful Grant Writing and Application

Thomas Rieg
Head, CID, NMCP, NME

Military Medicine



Dr. Steven Kaminsky, USUHS

Writing Your Grant

Components of the Grant

- Research Plan
  - Abstract
  - Specific Aims
  - Background
  - Preliminary Data
  - Research Design and Methods
- Resources and Facilities
- Budget
- Budget Justification

Foundation of a Grant

- It asks an important health related question and makes a bridge between the question and the research
- It demonstrates how the proposed study will make progress toward that biomedical challenge
- Evaluation Criteria
  1. The question: Does it challenge central dogma?
  2. The logic: Is it clean and is it clearly presented?
  3. The resources: Do you have the people to complete the study?

Phases of Grant Writing

Phase I - Idea Vetting

Never work on an island, seek collective intellect

Phase II – Time Management and Writing

Planning and staying on timelines will make the process manageable

Phase III – Presentation Vetting

Others will see what you cannot

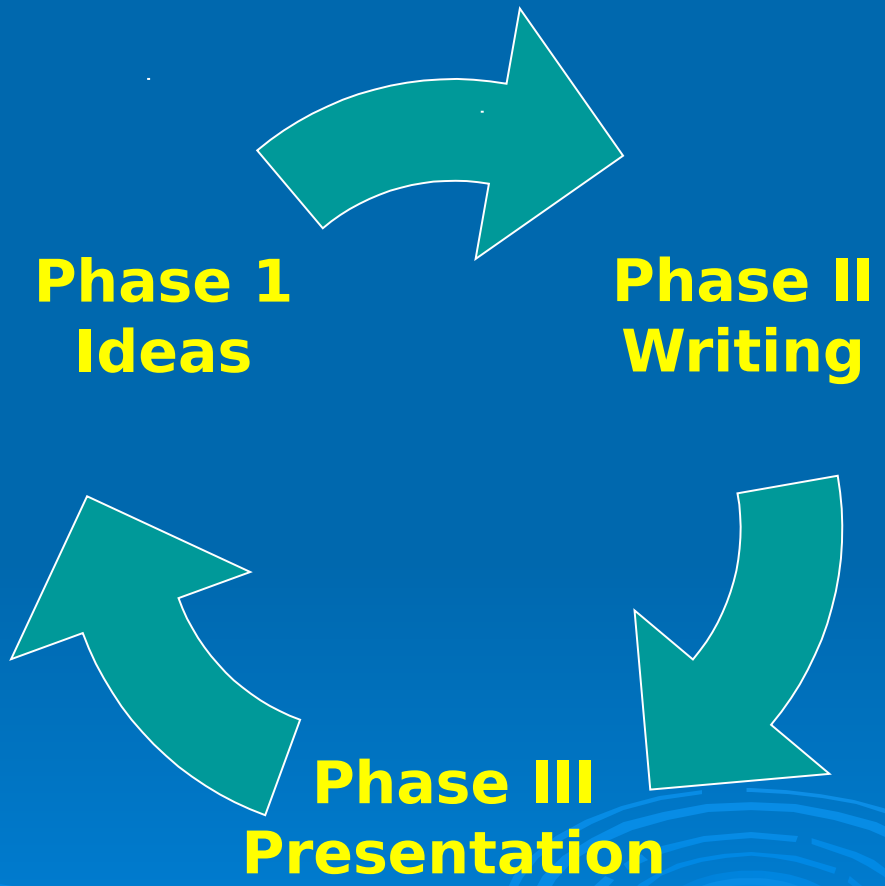
Fate of a Grant

- Scored

1. Funded
2. Not funded

- Not scored

1. Bad Idea
2. Bad Presentation



How long should my grant be?

NIH Proposal
- Specific Aims: 1 page
- Background: 3 pages
- Preliminary Results: 6-8 pages
- Research Design: 8-10 pages

Fellowships
- Much shorter
- Looking at your
  1. Track record
  2. Idea
  3. Mentor

Again: How long should my grant be?

The 25 Page Proposal

1. Specific Aims: 1 page
2. Background: 3 pages
3. Prelim Results: 6-8 pages
4. Research Design: 8-13 pages

The 15 Page Proposal

1. Specific Aims: 1 page
2. Background: 2-3 pages
3. Prelim Results: 3-4 pages
4. Research Design: 6-7 pages

1st Section: Specific Aims

- This is one of the two most important sections of any grant
- It must quickly engender enthusiasm for your idea.
- The flow of logic must be compelling
- It serves as a template for the rest of your proposal

- Write this section first and then have it reviewed and vetted by subject matter experts before you write the other sections of the grant

Specific Aims

- Summarize in one paragraph the broad scientific or medical context of your proposal
- In a second paragraph state your long-term goal and explain how it solves a fundamental problem
- Formulate a hypothesis addressing this fundamental problem
  - It is testable with definitive yes/no answ
  - A reasonable alternative hypothesis exis
  - The hypothesis emphasizes mechanism
- Then hypothesis is not
  - A method in search of a problem
  - A fishing expedition that lacks solid scientific basis

First Impressions

- This section is the entry point for the reviewer to your grant proposal
- It is likely that the reviewer will come to a general conclusion regarding your work by the time they finish this page
- It has to outline the area, identify the gap of knowledge, formulate a hypothesis and demonstrate how you are going to prove or disprove it

Recommended Structure

- Introductory Paragraph
  - Opening sentence setting the stage and general area of work. Frames the problem. End with your long range goal
- The “What and Why” Paragraph
  - Address what is known, including your contributions. Should clearly articulate the gap in the field, your objectives toward this gap and your hypothesis to fill this gap
- Aims Paragraph (in a numbered format)
- The “Payoff” Paragraph
  - Addresses expectations, illustrates innovation, and leads the reviewer to recognize the impact of the work

Introductory Paragraph

- This paragraph sets the stage by identifying the area of research and what the proposal is about
- It should convince the reviewer there is a problem that is relevant to the funding agency
- It should summarize what is known and what is unknown as they relate to the biomedical issue
- End with your long range goal, which should be in alignment with the funding agency's goals

Your Long Range Goal

- This is not the goal of the current application
- This is your career goal and the current application is only one part of it

- By definition, your long range goal and the mission of the funding agency should align
- Be realistic and do not overstate your labs capabilities

Introductory Paragraph

Introduce the field
Relevance to funding source
Key knowns and unknowns

Critical Need or gap in knowledge

Your long range goal as it relates to the area

Second Paragraph - Solutions

- The primary goal here is to convince the reviewers that you have a solution that fills the gap in knowledge
- This paragraph should be designed to closely match the critical need identified in the 1st paragraph

- Briefly outline what literature defines the gap and your contributions in this area
- Make a logical transition to your objective to fill the gap in knowledge and state your hypothesis in this regard

Central Hypothesis

- Make sure that it is a real hypothesis
  - Defined as "A tentative assumption made in order to test its logical or empirical consequence"
  - The effects of the Independent Variable upon the Dependent Variable
- The evidence that is presented prior to the hypothesis should illustrate that your hypothesis would be the "first choice" from among all alternatives
- It must be compatible with all that exists in the literature
- Please remember any hypothesis could be invalid

Central Hypothesis

- Your hypothesis should addresses an issue within your area of expertise
- It is testable with definitive yes/no answers
- Reasonable alternative hypothesis exists
- The hypothesis emphasizes mechanism
- The hypothesis is not
  - A method in search of a problem
  - It should test a solution

Third “Paragraph” – List of Aims

- This is a listing of your aims to test your hypothesis
- A logical step-by-step development of key activities by which you will fulfill the objective to completely address the hypothesis
- Two to four in number depending on the number of mechanisms
- Brief, focused, and limited scope

Third Paragraph – List of Aims

- Each should be presented as an "***eye-catching***" headline
- Each should flow logically to the next, but the feasibility of one aim should not depend upon a particular outcome of another

- Taken together they must collectively fill the identified need to prove or disprove the hypothesis

Fourth Paragraph - The Payoff

- The purpose of this paragraph is to inform the reviewer exactly what the return on investment will be and why this work is of value to the sponsoring agency
- This is key in illustrating that you get the “big picture”
- Make it easy for the reviewer to understand why your project stands out as unique

Fourth Paragraph cont'd

- When you write about the expectations make sure they are specific and credible
- Must relate to your opening sentence
- Address the collective impact
  - i.e., how these outcomes will fill the identified, concludes this section
- Ends of story: Do they live happily ever after?

2nd Section: Background

- Why is your problem importa
- To whom is it important ?
- What exists in the literature ?
- What needs to be done ?
- If everything works what will be achieved?

- Can you write it in 9-12 paragraphs?

3rd Section: Preliminary Results

- Builds reviewers' confidence that you have mastered the technologies
- Illustrates that you understand limitations of the proposed methods
- Demonstrates that you can critically interpret the data with due recognition of alternative meanings

- Each section should be founded on the following logic
  - The question being asked
  - Rational for asking that question
  - Design of experiments and results
  - How it relates to your hypothesis and Specific Aims

4th Section: Research Design

- This section will determine whether or not the reviewer concludes that you are familiar with current methodology and its limitations
- Together with the preliminary studies section, it will establish feasibility of the proposed research and your competency
- You need to convince the reviewer that you can adapt to unanticipated outcomes
- Be sure that the experimental plan does not assume that the proposal hypothesis is true

Research Design and Methods

- Each Specific Aim should have the following
  - Rationale
  - Experimental Design
  - Expected Results
  - Pitfalls and Alternative
  - Significance

You do not want a reviewer to make this comment about your application:

"In addition to proposing a research design that is a fishing expedition, the applicant also proposes to use every type of bait and piece of tackle ever known to mankind."

Key Features of Your Grant

- For clarity of thought, use simple declarative sentences.
- Avoid complicated phases, unusual abbreviations and tortuous syntax
- Avoid discontinuities in reading that interrupt the reader
- Avoid “weak” works that convey doubt
- Keep

Reviewers' Perspective

- Your application should be attractive and concise
- Your application should be easy to read
- Make your application comprehensible in a focused area
- Keep abbreviations and acronyms to a minimum.
- Write for the reviewers
  - They are your advocate at study section. Make it easy for them to present and defend what you want to do

Reviewers' Perspective

Define the Area of Biomedical Research

Identify the Gap in Knowledge

Develop Objectives

Formulate a Testable Hypothesis

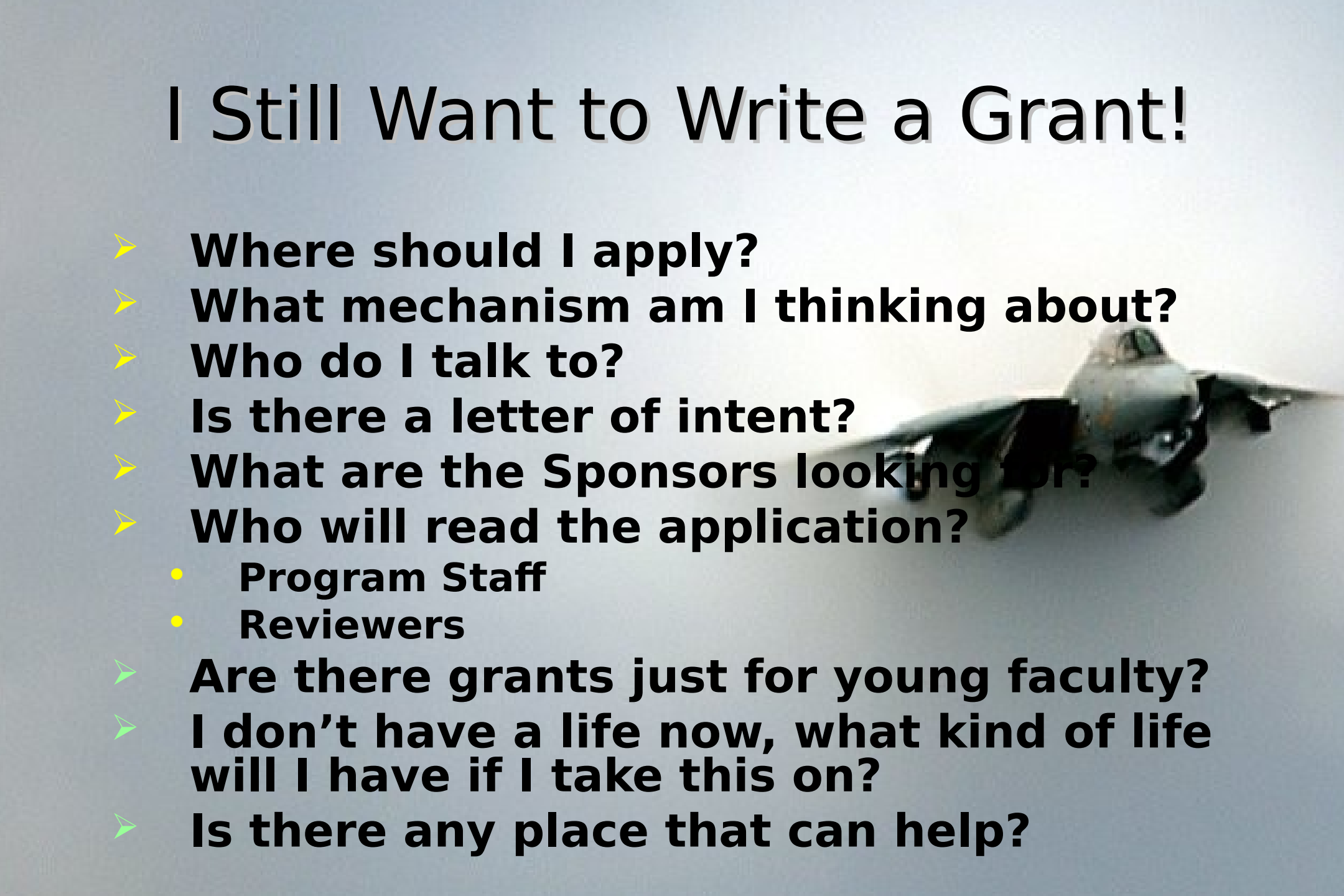
Design Specific Aims to Prove or Disprove the Hypothesis

Articulate the Expected Outcome and Significance

Reviewers Focus on Four Cs

- Clarity: Cross-reference current literature in laying out plans
- Content: Organization of ideas
  - Mission statement of each IC
- Coherence of Concepts: Set of ideas predicated on previous work
- Cutting Edge: Take risks based on preliminary data. Innovative application

I Still Want to Write a Grant!

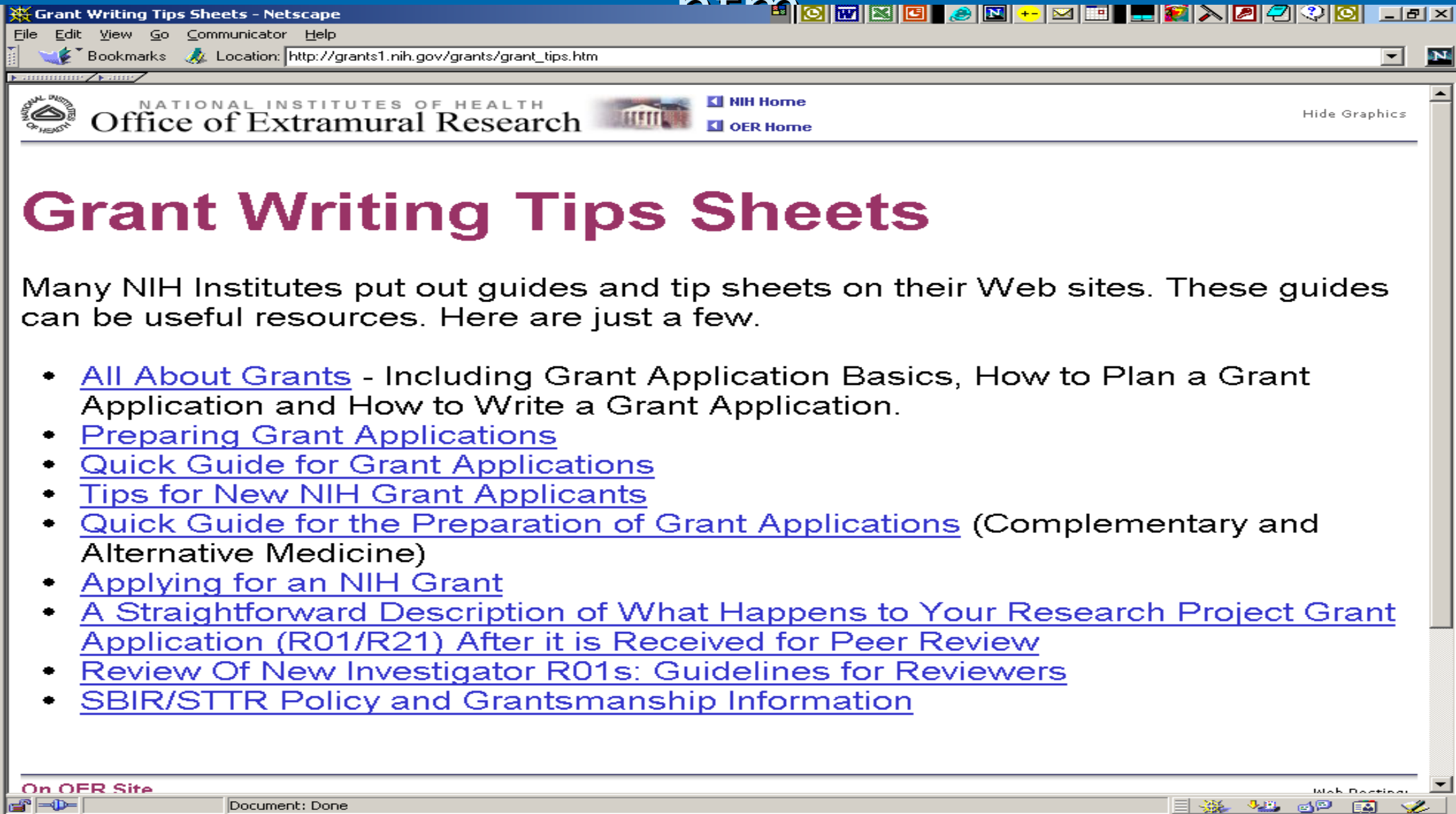


- **Where should I apply?**
- **What mechanism am I thinking about?**
- **Who do I talk to?**
- **Is there a letter of intent?**
- **What are the Sponsors looking for?**
- **Who will read the application?**
  - **Program Staff**
  - **Reviewers**
- **Are there grants just for young faculty?**
- **I don’t have a life now, what kind of life will I have if I take this on?**
- **Is there any place that can help?**

Online Resources

- **Office of Extramural Research: Grants Page**
  - **http://grants1.nih.gov/grants/index.cfm**
- **Center for Scientific Review**
  - **http://www.csr.nih.gov**
- **Referral and Review**
  - **http://www.csr.nih.gov/refrev.html**
- **Overview of Peer Review Process in CSR**
  - **http://www. csr.nih.gov/review/peerrev.html**
- **NIH Peer Review Notes**
  - **http://www.csr.nih.gov/prnotes/prnotes.html**

http://grants1.nih.gov/grants/grant_tips.htm


Grant Writing Tips Sheets - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://grants1.nih.gov/grants/grant_tips.htm
NATIONAL INSTITUTES OF HEALTH
Office of Extramural Research
NIH Home
OER Home
Hide Graphics
Grant Writing Tips Sheets
Many NIH Institutes put out guides and tip sheets on their Web sites. These guides can be useful resources. Here are just a few.
All About Grants - Including Grant Application Basics, How to Plan a Grant Application and How to Write a Grant Application.
Preparing Grant Applications
Quick Guide for Grant Applications
Tips for New NIH Grant Applicants
Quick Guide for the Preparation of Grant Applications (Complementary and Alternative Medicine)
Applying for an NIH Grant
A Straightforward Description of What Happens to Your Research Project Grant Application (R01/R21) After it is Received for Peer Review
Review Of New Investigator R01s: Guidelines for Reviewers
SBIR/STTR Policy and Grantsmanship Information
On OER Site
Document: Done

How to Write a Grant Application

- http://grants1.nih.gov/grants/grant_tips.htm
- http://www.niaid.nih.gov/ncn/grants/
- http://www.nnlm.nlm.nih.gov/scr/edn/grants-resources.htm
- http://grants2.nih.gov/grants/grant_tips.htm
- http://www.nigms.nih.gov/funding/tips.html
- http://www.nigms.nih.gov/funding/moregrant_tips.html
- http://deainfo.nci.nih.gov/EXTRA/EXTDOCS/gntapp.htm
- http://chroma.med.miami.edu/research/Ellens_how_to.html
- http://www.cfda.gov/public/cat-writing.htm
- http://cpmcnet.columbia.edu/research/writing.htm

It’s Coming!

- Grantwriting is in your Future
- Surgeon General’s Fund
- CRADA, MOU, ISSA
- Due to limited available Funds
- New Hire – Grant writer
- Become Self Sufficient

Anticipated Timeline

- 24 Sept – Discussion of Form/Policy
- 5 Oct – Final Draft
- 16 Oct – Announcement
- 6 Nov – Proposals Due
- 13 Nov – Committee Meets
- Release of Funds

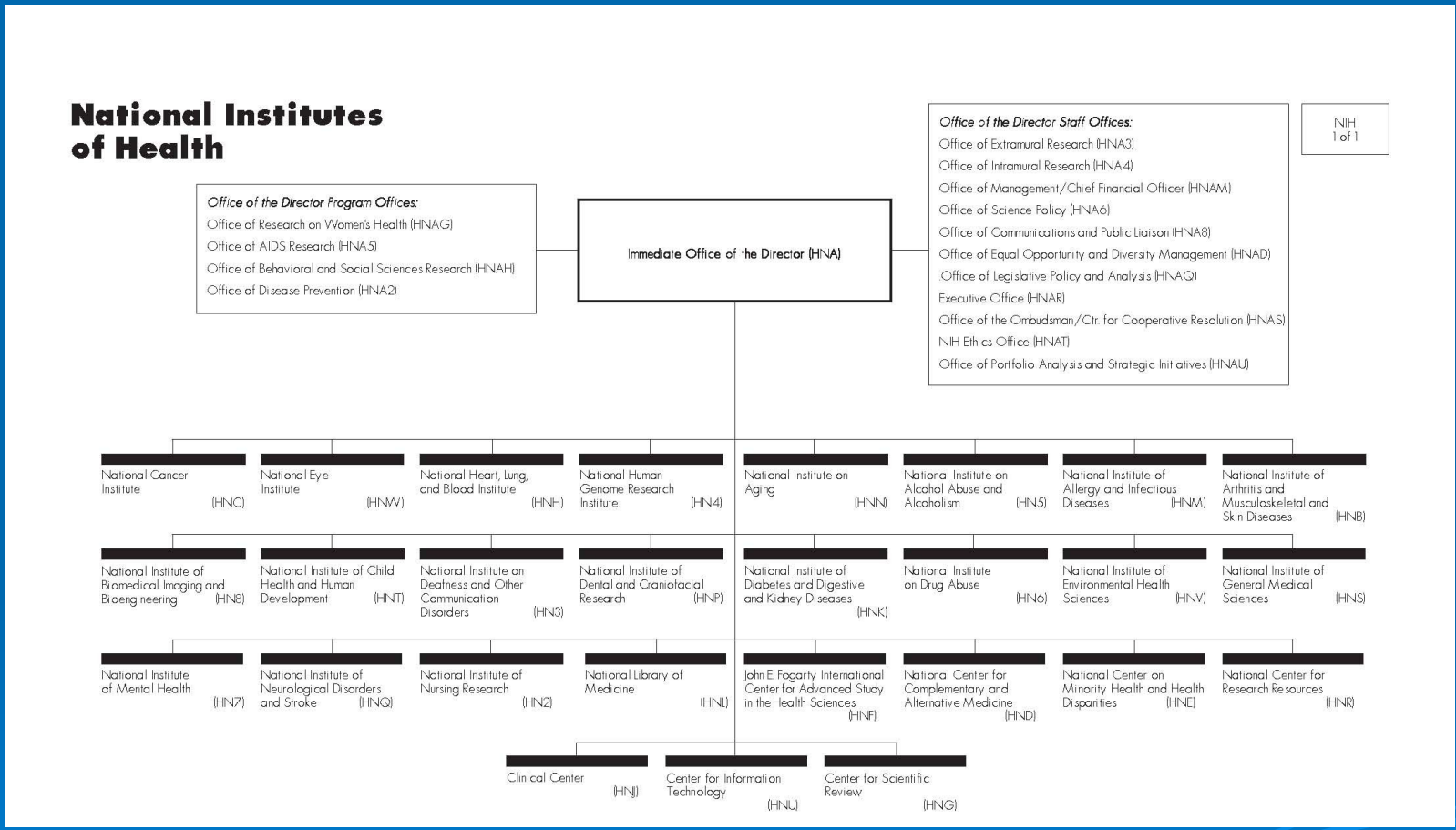
The End

Questions?
Comments?

National Institute of Health (NIH)

Most biomedical research in the United States is supported by the Federal Government, and primarily by the National Institutes of Health (NIH)

NIH Org Chart


National Institutes of Health
Office of the Director Program Offices:
Office of Research on Women's Health (HNAG)
Office of AIDS Research (HNA5)
Office of Behavioral and Social Sciences Research (HNAH)
Office of Disease Prevention (HNA2)
Immediate Office of the Director (HNA)
Office of the Director Staff Offices:
Office of Extramural Research (HNA3)
Office of Intramural Research (HNA4)
Office of Management/Chief Financial Officer (HNAM)
Office of Science Policy (HNA6)
Office of Communications and Public Liaison (HNA8)
Office of Equal Opportunity and Diversity Management (HNAD)
Office of Legislative Policy and Analysis (HNAQ)
Executive Office (HNAR)
Office of the Ombudsman/Ctr. for Cooperative Resolution (HNAS)
NIH Ethics Office (HNAT)
Office of Portfolio Analysis and Strategic Initiatives (HNAU)
NIH 1 of 1
National Cancer Institute (HNC)
National Eye Institute (HNW)
National Heart, Lung, and Blood Institute (HNH)
National Human Genome Research Institute (HN4)
National Institute on Aging (HNN)
National Institute on Alcohol Abuse and Alcoholism (HN5)
National Institute of Allergy and Infectious Diseases (HNM)
National Institute of Arthritis and Musculoskeletal and Skin Diseases (HNB)
National Institute of Biomedical Imaging and Bioengineering (HN8)
National Institute of Child Health and Human Development (HNT)
National Institute on Deafness and Other Communication Disorders (HN3)
National Institute of Dental and Craniofacial Research (HNP)
National Institute of Diabetes and Digestive and Kidney Diseases (HNK)
National Institute on Drug Abuse (HN6)
National Institute of Environmental Health Sciences (HNV)
National Institute of General Medical Sciences (HNS)
National Institute of Mental Health (HN7)
National Institute of Neurological Disorders and Stroke (HNQ)
National Institute of Nursing Research (HN2)
National Library of Medicine (HNL)
John E Fogarty International Center for Advanced Study in the Health Sciences (HNF)
National Center for Complementary and Alternative Medicine (HND)
National Center on Minority Health and Health Disparities (HNE)
National Center for Research Resources (HNR)
Clinical Center (HNJ)
Center for Information Technology (HNU)
Center for Scientific Review (HNG)

- Note Center for Scientific Review (CSR or Study Section)
- Note Institute or Center (IC)

Applications Submitted to NIH

- Approximately 50,000+ grant applications are submitted to NIH each year
- 11-30% are funded
- Competing grant applications are received for three review cycles per year

The Review Process

Research Grant Application (PI)

Principal Investigator Initiates Research Idea

Research Center (Applicant)

Submits application

National Institutes of Health

Center for Scientific Review

Assign to **IC and IRG**

Scientific Review Group

Review for Scientific Merit

Institute

Evaluate for Relevance

Advisory Council or Board

Recommends **Action**

Institute Director

Takes final action for NIH Director

Allocates Funds $$

PI Conducts Research

Dual Review System

- **First Level of Review**
  - Scientific Review Group (SRG)
    - Provides Initial Scientific Merit
    - Review of Grant Applications
    - Rates Applications and
    - Recommends Level of Support and Duration of Award

- **Second Level of Review**
  - Advisory Council
    - Assesses Quality of SRG Review of Grant Applications
    - Makes Recommendation to Institute Staff on Funding
    - Evaluates Program Priorities and Relevance
    - Advises on Policy

Center for Scientific Review

- **Central receipt point for PHS applications**
- **Referral to Institutes (Funding Components) and to Study Sections (Review Components)**
- **Study sections review of most investigator initiated research and research training applications for scientific merit**

Focal Point for Initial Review at NIH

Assignment to CSR Study Section

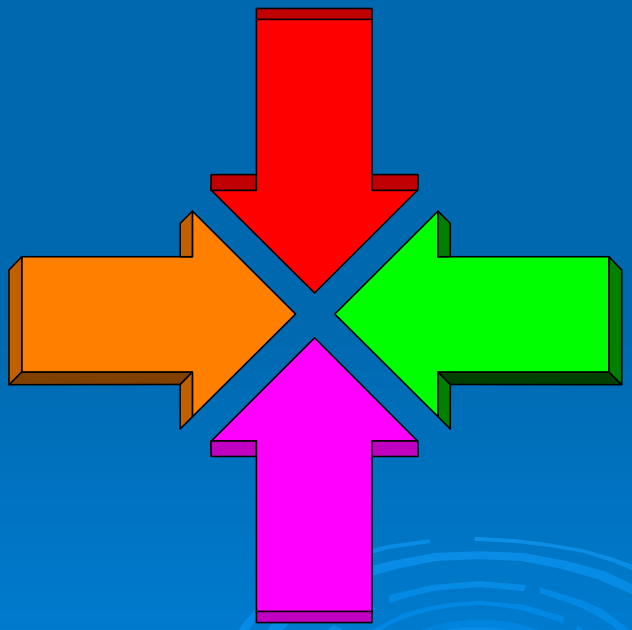
- Applications are referred to an Institute or Center as the potential funding component
- Applications assigned to study sections known as Scientific Review Groups (SRG) based on:
  - specific referral guidelines for each SRG and
  - information contained in your application
- More information at: http://era.nih.gov/roster/index.cfm

Assignment to Institutes

- Applications are referred to an Institute or Center as the potential funding component
- Assignment is based on a match between the research proposed and the overall mission of the Institute or Center
- Where applications are appropriate for more than one Institute or Center, multiple assignments are made

WHO DETERMINES WHICH GROUP REVIEWS THE APPLICATION?

- **YOU DO!**
  - **The words in your application**
  - **Your title**
  - **Your abstract**
  - **Your specific aims**
  - **Your methods**



Peer Review at NHI

- Study Sections are managed by a Scientific Review Administrator (SRA) who is a professional (at PhD or MD level) whose scientific background is close to the expertise of the study section
- Each study section usually has 12-24 members who are primarily from academia
- 60-100 applications are reviewed at each study section meeting
- There are several hundred study section meetings

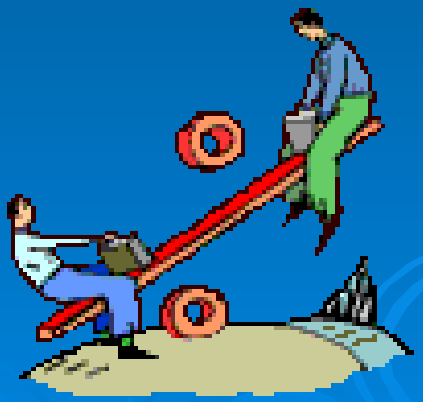
Members' Expertise

- Surgery, Anesthesiology and Trauma Study Section
  - Biochemistry
  - Burn Physiology and Electrolyte Metabolis
  - Cardiovascular and Pulmonary Physiology
  - Clinical Anesthesiology
  - Drug Metabolism (Anesthetics)
  - General Surgery
  - Immunology and Transplantation
  - Nutrition
  - Pharmacology (Analgesics, Narcotics and Antagonists)
  - Pulmonary Embolism
  - Shock and Trauma
  - Toxicology of Anesthetic Drugs
  - Vascular Surgery

Study Section Actions

- Scored, Scientific Merit Rating
- Priority scores:
  - 1 (best) to 5 (poorest) and percentiles
  - $P = 100 \times (R - ½) / N$
- Unscored (lower half)
- Deferral

Understanding NIH Peer Review



What Determines Which Awards are Made?

- Scientific merit
- Program considerations
- Availability of funds

You do not want a reviewer to make this comment about your application

"This application is characterized by ideas that are both original and scientifically important. Unfortunately the ideas that are scientifically important are not original and the ideas that are original are not scientifically important."

Rule Number 1

Study Sections do not fund!

Institutes Fund!

Rule Number 2

You must satisfy the needs of the reviewers

and

You must satisfy the needs of the funding agency

Rule Number 3

Reviewers are never wrong

Reviewers are never right

Reviewers simply provide an assessment of your materials

Rule Number 4

Don't be sad:

The comments in the summary statements are never about you as a person

The comments are about the material that you provided in your application and the way in which you provided the information

Corollary to Rule No. 4

- Comments in the summary statement only list some of the weaknesses, not all of the weaknesses

  The revision of the application is an opportunity to improve the entire application, not just the obvious weaknesses

Study Sections Judge

- **Scientific and Technical Merit**
- **Institute staff evaluate relevance of applications**
  - **Focus on Institute's mission, research priorities and portfolio of existing research**

Study Sections do NOT Fund Institutes Fund

Requests for Applications (RFA)

- Announcement describing an institute initiative in a well-defined scientific area
- Invitation to submit research grant applications for a one-time competition on a specific topic
- *Set-aside of funds for a certain number of awards*
- Applications generally reviewed within the issuing institute

Reviewers Focus on Four Cs

- Clarity: Cross-reference current literature in laying out plans
- Content: Organization of ideas
  - Mission statement of each IC
- Coherence of Concepts: Set of ideas predicated on previous work
- Cutting Edge: Take risks based on preliminary data. Innovative application

Criteria used by Reviewers

- Significance: Will it affect concepts or methods in the field
- Approach: Appropriate design or alternative approaches
- Innovation: Novel concepts, approaches, methods
- Investigator: Appropriately trained personnel
- Environment: Institutional support

The End

Questions?
Comments?